

PATENT APPLICATION
09/042,666 (A7139)

Claims 1-11 have been rejected under §103 as unpatentable over the '307 patent to Arbore. Claims 12 and 13 have been rejected over the '307 patent, as combined with the '707 patent to Huber. Claims 14-27 have been allowed.

It is apparent that the Examiner's primary reference is the '307 patent to Arbore. In response to a prior Office Action citing this reference, Applicants have argued that the mechanism of pulse compression disclosed by this reference is not applicable to optical parametric interactions. Applicants currently maintain this contention at the present time, but do not wish to belabor this issue with complex technical proofs. Instead, Applicants wish to focus primarily in this response upon another novel feature of the invention not addressed by the Examiner or found in the prior art, this being the use of an optical parametric generation element formed as an optical waveguide. This is also a very important feature of the invention.

Prior to the present invention, it was not possible to achieve optical parametric generation using only the unamplified output of a mode-locked ultrashort-pulse laser because of the relatively high threshold for optical parametric generation (approximately 50nJ). For this reason, prior systems seeking efficient optical parametric wavelength conversion have generally been arranged such that pump pulses and signal pulses from separate lasers were made to temporally overlap in a bulk non-linear crystal provided in a separate optical cavity. The need for such a difficult and expensive arrangement is obviated by the present invention. Specifically, the present invention demonstrates for the first time that the threshold for OPG can be lowered into the energy range reachable by current ultrashort-pulse oscillators by using specially designed waveguides of, e.g., periodically-poled lithium niobate. A fundamental reason for this advantage enjoyed by waveguides as opposed to bulk crystals resides in that OPG threshold in a waveguide is dependent upon the pulse duration, whereas this is not the case for bulk materials.

Turning now to the Arbore reference, it is apparent from Figure 1 and numerous references within the Arbore patent that the non-linear optical material used therein is provided in bulk form. There is no mention of waveguides anywhere within the patent. Hence, it is apparent that Arbore did not consider, and therefore cannot disclose or suggest, the implementation of a waveguide-form OPG. No other conclusion is possible with respect to the disclosure of this reference.

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In contrast, claim 1, and therefore each of claims 1-13 of the present application, clearly requires "an optical waveguide including an optical parametric generation portion". Such a device, per se, is unknown from the prior art of record and, in any event, is clearly not suggested by Arbore.

Accordingly, it is clear from the above that the Arbore patent remains significantly deficient with respect to one of the key elements recited in all of the currently pending claims. For this reason, the Examiner is kindly requested to reconsider his position.

Finally, in the Office Action, the Examiner takes the position that frequency conversion elements such as second harmonic generators "are well known in the art to include optical fiber gratings". Applicants challenge the Examiner to substantiate this claim. Non-linear elements capable of SHG or OPG do not exist in fiber grating form. Since this "teaching" asserted by the Examiner does not in fact exist, it is apparent that a key link in the logic of the obviousness rejection is flawed and cannot stand.

In view of the foregoing, favorable reconsideration of the subject application is kindly requested. Should the Examiner have any questions concerning the subject case, he is invited to contact the undersigned attorney at the local telephone number listed below.

Respectfully submitted,



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Date: March 21, 2000